

PATENT ABSTRACTS OF JAPAN

(11) Publication number :

2003-130082

(43) Date of publication of application : 08.05.2003

(51) Int.CI.

F16D 3/22

B62D 1/19

F16D 3/223

F16D 3/224

(21) Application number : 2001-329548

(71) Applicant : NTN CORP

(22) Date of filing : 26.10.2001

(72) Inventor : YAMAZAKI KENTA

IZUMINO JUNICHI

TERADA KENJI

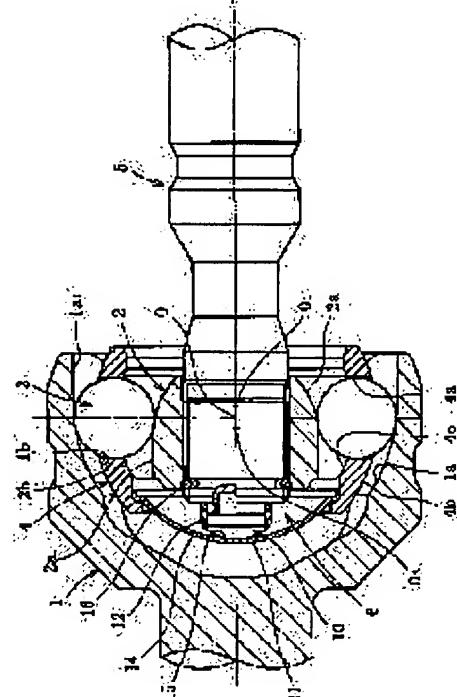
KURA HISAAKI

(54) FIXED TYPE UNIFORM SPEED UNIVERSAL JOINT

(57) Abstract:

PROBLEM TO BE SOLVED: To provide a fixed type uniform speed universal joint suitable for use in the field disliking rotary backlash.

SOLUTION: A pushing member 10 is fitted to a shaft 5 and a receive member 14 is fitted to a retainer 4. The pushing part 11 of the pushing member 10 is elastically brought into contact with the receive part 15 of the receive member 14. Thereby the inside ring 2 and the retainer 4 are axially moved relatively. The ball 3 is pushed into the contracting direction of a wedged ball track to reduce the axial clearance of the track.



[Kind of final disposal of application other than
the examiner's decision of rejection or
application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's
decision of rejection]

[Date of requesting appeal against examiner's
decision of rejection]

[Date of extinction of right]

*** NOTICES ***

JPO and INPIT are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] The method member of outside equipped with the spherical inside in which two or more truck slots were formed, and the method member of inside [having the spherical external surface in which two or more truck slots were formed], The ball arranged on the vault rack of the wedge formed in the truck slot of the method member of outside, and the truck slot of the method member of inside, In the cover-half uniform universal joint equipped with the cage which is arranged between the spherical inside of the method member of outside, and the spherical external surface of the method member of inside, and holds a ball The cover-half uniform universal joint characterized by establishing another side in an inner direction member while preparing either in a cage among the press section which makes elastic thrust act on shaft orientations, and the receptacle section which receives the thrust from the press section.

[Claim 2] The cover-half uniform universal joint according to claim 1 made to act so that elastic thrust may be stuffed into a ball through a cage at the contraction side of a vault rack.

[Claim 3] The cover-half uniform universal joint according to claim 1 or 2 which made the axial internal clearance between an inner ring of spiral wound gasket and a cage larger than the axial internal clearance between trucks.

[Claim 4] claims 1-3 which it is prepared by the cage among the press section and the receptacle section, while were formed in the shape of [of a major diameter] the concave spherical surface rather than the spherical external surface of an inner direction member -- the cover-half uniform universal joint of any or a publication.

[Claim 5] The cover-half uniform universal joint according to claim 4 which formed another side established in an inner direction member among the press section and the receptacle section in the shape of [of a minor diameter] the convex spherical surface rather than the method of top Norikazu.

[Claim 6] The cover-half uniform universal joint of the TSUEPPA mold which has the structure indicated by any of claims 1-5 they are.

[Claim 7] The cover-half uniform universal joint of the undercut free mold which has the structure indicated by any of claims 1-5 they are.

[Claim 8] claims 1-7 used for a steering system -- the cover-half uniform universal joint of any or a publication.

[Translation done.]

*** NOTICES ***

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the suitable cover-half uniform universal joint for the application which dislikes especially rotation backlash about a cover-half uniform universal joint and the steering system which has this.

[0002]

[Description of the Prior Art] a uniform universal joint -- the include angle between I/O shafts -- the cover half which permits only a variation rate, and an include angle -- a variation rate and shaft orientations -- it is divided roughly into the sliding mold which permits a variation rate, and model selection is carried out according to an application, a service condition, etc., respectively.

[0003] As a cover-half uniform universal joint, the TSUEPPA mold ("BJ" is called hereafter) and the undercut free mold ("UJ" is called hereafter) are known widely.

[0004] Both BJ and UJ consist of a ball incorporated between the truck slots of the outer ring of spiral wound gasket which has the truck slot of the shape of two or more curve in inner circumference, the inner ring of spiral wound gasket which has the truck slot of the shape of two or more curve on a periphery, and an outer ring of spiral wound gasket and an inner ring of spiral wound gasket, and a cage holding a ball. The vault rack with which the family truck center is offset by shaft orientations at the opposite side to the spherical-surface core of an inner-ring-of-spiral-wound-gasket periphery as opposed to the spherical-surface core of outer-ring-of-spiral-wound-gasket inner circumference, respectively, and, as for the truck center of an outer ring of spiral wound gasket, only the equal distance consists of a truck slot on the outer ring of spiral wound gasket and a truck slot on family by this serves as a wedge extended towards the inner side of an outer ring of spiral wound gasket, or an opening side. Although it has become curve [BJ / whole region / of each truck slot]-like consisting mainly of an outer-ring-of-spiral-wound-gasket truck center and an inner-ring-of-spiral-wound-gasket truck center, in UJ, one edge of each truck slot is the shape of a straight of shaft orientations.

[0005]

[Problem(s) to be Solved by the Invention] A clearance exists in these cover-half uniform universal joints from the request on a function and processing between an outer-ring-of-spiral-wound-gasket truck and an inner-ring-of-spiral-wound-gasket truck. The clearance between this truck says the movement magnitude when fixing either an inner ring of spiral wound gasket or an outer ring of spiral wound gasket in the state of neutrality of a joint, and moving the member of another side which is not being fixed in a radial direction or the axial direction, and is called a radial internal clearance or an axial internal clearance by the direction to which it is made to move, respectively.

[0006] By the way, the size of the clearance between this truck affects greatly the backlash (rotation backlash) of the circumferencial direction between an inner ring of spiral wound gasket and an outer ring of spiral wound gasket (rotation backlash also becomes large, so that the clearance between trucks is large). It will not have resulted, by the time the clearance between trucks is indispensable, therefore general adoption of this kind of cover-half uniform universal joint is carried out by the cover-half

uniform universal joint as mentioned above at the application which dislikes rotation backlash like the steering system of an automobile, since generating of the rotation backlash more than fixed is not avoided.

[0007] Then, this invention aims at offer of the suitable cover-half uniform universal joint for use for the application which dislikes rotation backlash.

[0008]

[Means for Solving the Problem] The method member of outside equipped with the spherical inside in which two or more truck slots were formed, by this invention for achievement of the above-mentioned purpose, The ball arranged on the wedge-shaped vault rack formed in the way member, and the truck slot of the method member of outside and the truck slot of the method member of inside while it had the spherical external surface in which two or more truck slots were formed, In the cover-half uniform universal joint equipped with the cage which is arranged between the spherical inside of the method member of outside, and the spherical external surface of the method member of inside, and holds a ball While preparing either in the cage among the press section which makes elastic thrust act on shaft orientations, and the receptacle section which receives the thrust from the press section, another side was established in the inner direction member.

[0009] Thus, by preparing the press section and the receptacle section in the method member of inside, or a cage, respectively, an inner direction member and a cage are displaced relatively to shaft orientations according to elastic force. Thereby, since the clearance between trucks (axial internal clearance) is packed through a ball, it becomes possible to prevent rotation backlash.

[0010] When are explained concretely, and the press section 11 is formed in the inner direction member 6 and the receptacle section 15 is formed in a cage 4, respectively as shown, for example in drawing 1, popularity is won with the press section 11, and a cage 4 is pressed at the inner side of the method member 1 of outside, the inner direction member 2 is pressed by elastic contact of the section 15 at the opening side of the method member 1 of outside, respectively, and relative displacement of shaft orientations arises among both. Since a ball 3 is pushed in in the contraction direction of a vault rack through a cage 4 by this relative displacement, the axial internal clearance between trucks is packed by it, and generating of rotation backlash is prevented. On the other hand, as shown in drawing 8, also when it forms the press section 11 in a cage 4 and the receptacle section 15 is formed in the inner direction member 6, respectively, a ball 3 is similarly pushed in in the contraction direction of a vault rack, consequently the axial internal clearance between trucks is packed, and rotation backlash is prevented.

[0011] It is necessary to make elastic thrust act so that also from the above, and a ball may be stuffed into the contraction side of a vault rack. As a generating means of elastic thrust, the elastic member which consists of spring materials, such as spring members, such as coiled spring, a wave spring, and a disk spring, and resin, rubber, can be considered.

[0012] By the way, generally in a cover-half uniform universal joint, a minute spherical-surface clearance is formed from the reasons of processing and a function between an inner ring of spiral wound gasket and a cage and between an outer ring of spiral wound gasket and a cage. Among these, since a cage will contact an inner ring of spiral wound gasket before packing the axial internal clearance between trucks completely if the axial internal clearance formed in the spherical-surface clearance between an inner ring of spiral wound gasket and a cage is smaller than the axial internal clearance between trucks, there is a limitation in packing the axial internal clearance between trucks more than it. Therefore, as for the axial internal clearance between an inner ring of spiral wound gasket and a cage, it is desirable to make it larger than the axial internal clearance between trucks.

[0013] It is desirable to form [which prepares in a cage 4 among the press section 11 and the receptacle section 15] in the shape of [of a major diameter] the concave spherical surface rather than spherical external surface 2b of the inner direction member 6 on the other hand (for example, winning popularity by drawing 1 section 15). the situation which prepared in the cage 4, while contacts and interferes with spherical external surface 2b of the inner direction member 6 also when this takes an actuation angle -- it can prevent -- a smooth include angle -- a variation rate becomes possible.

[0014] If another side (the above-mentioned instantiation press section 11) established in the inner direction member 6 among the press section 11 and the receptacle section 15 is formed in the shape of [of a minor diameter] the convex spherical surface rather than the method of top Norikazu, popularity is won with the press section 11, the section 15 can be slid smoothly, and the variation rate of an actuation angle can be performed easily.

[0015] As mentioned above, the cover-half uniform universal joint of the TSUEPPA mold which has which structure mentioned above, or an undercut free mold does not produce rotation backlash, therefore these cover-half uniform universal joints become a suitable thing also for the application which dislikes rotation backlash like a steering system.

[0016] If the above-mentioned cover-half uniform universal joint is used for a steering system, since rotation backlash does not exist, a good feeling of steering can be obtained, and the vibration under transit can also be lost few.

[0017]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained based on drawing 1 - drawing 13.

[0018] Drawing 1 - drawing 12 illustrate the case where this invention is applied to the undercut free mold (UJ) which is a kind of a cover-half uniform universal joint.

[0019] As shown in drawing 1, this type of uniform universal joint The outer ring of spiral wound gasket 1 as a method member of outside equipped with spherical inside 1b in which two or more truck slot 1a was formed, Two or more balls 3 arranged on the vault rack formed by collaboration with the inner ring of spiral wound gasket 2 equipped with spherical external surface 2b in which two or more truck slot 2a was formed, and truck slot 1a of an outer ring of spiral wound gasket 1 and truck slot 2a of an inner ring of spiral wound gasket 2, It is arranged between spherical inside 1b of an outer ring of spiral wound gasket 1, and spherical external surface 2b of an inner ring of spiral wound gasket 2, and let the cages 4 which have pocket 4a for holding a ball 3 in circumferential direction regular intervals be main components. The truck slots 1a and 2a make the shape of a curve prolonged in shaft orientations, and six (8 [or]) are usually formed in spherical inside 1b and spherical external surface 2b, respectively. The inner direction member 6 is constituted by combining a shaft 5 with the inner circumference of an inner ring of spiral wound gasket 2 through torque means of communication, such as serration and a spline.

[0020] In this operation gestalt, the core (outer-ring-of-spiral-wound-gasket truck center) O1 of a part that the groove bottom of truck slot 1a of an outer ring of spiral wound gasket 1 became curved surface-like As for the core (inner-ring-of-spiral-wound-gasket truck center) O2 of a part that the groove bottom of truck slot 2a of an inner ring of spiral wound gasket 2 became curve-like, only the equal distance is offset by shaft orientations in the opposite side to the spherical-surface core of spherical external surface 2b of an inner ring of spiral wound gasket 2 to the spherical-surface core of spherical inside 1b of an outer ring of spiral wound gasket 1, respectively.

[0021] Each spherical-surface core of spherical inside 1b of the outer ring of spiral wound gasket 1 used as the spherical-surface core of peripheral face 4b of a cage 4 and the slideway of cage peripheral face 4b is in agreement centering on [O] a joint. Moreover, the spherical-surface core of inner skin 4c of a cage 4 and the spherical-surface core of spherical external surface 2b of the inner ring of spiral wound gasket 2 used as the slideway of cage inner skin 4c are in agreement similarly centering on [O] a joint. So, the amount of offset of the outer-ring-of-spiral-wound-gasket truck center O1 serves as the outer-ring-of-spiral-wound-gasket truck center O1 and distance between the joint cores O, the amount of offset of the inner-ring-of-spiral-wound-gasket truck center O2 serves as the inner-ring-of-spiral-wound-gasket truck center O2 and shaft-orientations distance between the joint cores O, and both are equal.

[0022] As mentioned above, the wedge-shaped vault rack reduced from the opening side of an outer ring of spiral wound gasket 1 to an inner side by the truck slots 1a and 2a on the pair is formed, and each ball 3 is built into this vault rack possible [rolling].

[0023] although the spherical-surface core of peripheral face 4b of a cage 4 and inner skin 4c is made in agreement in drawing 1 centering on [O] a joint -- these spherical-surface cores -- the joint core O --

receiving -- each of shaft orientations -- the opposite side can also be made to offset only the equal distance

[0024] In this cover-half uniform universal joint, if an outer ring of spiral wound gasket 1 and an inner ring of spiral wound gasket 2 take the actuation angle theta as shown in drawing 4, the ball 3 guided at the cage 4 will always be maintained in the bisector ($\theta/2$) of an include angle theta in every actuation angle theta, and the uniform velocity nature of a joint will be secured. Since the straight section one a1 which made the groove bottom parallel with the axial center, respectively, and two a1 are formed in the edge of one side (outer-ring-of-spiral-wound-gasket opening side) of truck slot 1a of an outer ring of spiral wound gasket 1, and the edge of the other side (outer-ring-of-spiral-wound-gasket inner side) of truck slot 2a of an inner ring of spiral wound gasket 2 in UJ, The maximum of the actuation angle theta can be taken at about 50 degrees, and can be made larger than the general maximum-permissible actuation angle (about 46 degrees) of BJ.

[0025] In addition, in order to acquire smooth rotation actuation between an outer ring of spiral wound gasket 1 and an inner ring of spiral wound gasket 2, it is made into a forward clearance by each of a circumferencial direction and shaft orientations between pocket 4a of a cage 4, and a ball 3.

[0026] As shown in drawing 1, the press member 10 is attached in the axis end (outer-ring-of-spiral-wound-gasket inner side) of the shaft 5 which constitutes the inner direction member 6. As the press member 10 of the example of illustration is shown in drawing 2, cylinder-like drum section 10a and head 10b jutted out over the outer-diameter side rather than this are provided, and drum section 10a is inserted in the shaft axis end possible [the slide to shaft orientations] in the condition of having arranged on a shaft 5 and the same axle. Between head 10b and a shaft axis end, a coil spring is infixed as an elastic member 12, and this elastic member 12 serves as a generation source of the elastic force which presses the press member 10 to the outer-ring-of-spiral-wound-gasket inner side of shaft orientations. The end face of head 10b is formed in the shape of the convex spherical surface, and functions as the press section 11 which makes thrust with this elastic convex spherical-surface part act on shaft orientations.

[0027] The receptacle member 14 is attached in the edge by the side of the outer-ring-of-spiral-wound-gasket inner of a cage 4. This receptacle member 14 consists of [shape / of a wrap lid] spherical-surface section 14a of the shape of nothing and the partial spherical surface, and anchoring section 14b annularly formed in that periphery in edge opening by the side of the outer-ring-of-spiral-wound-gasket inner of a cage 4. The inside (a shaft 5 and field which counters) of spherical-surface section 14a is the concave spherical surface-like, and this concave spherical-surface section functions as the receptacle section 15 which receives the thrust from the press section 11. Anchoring section 14b is being fixed to the edge of a cage 4 with proper means, such as press fit and welding.

[0028] When an actuation angle is taken, in order to win popularity with the press member 10 and to slide a member 14 smoothly, as shown in drawing 3, the inside diameter Ro of the concave spherical-surface-like receptacle section 15 is made larger than the outer-diameter dimension r of the convex spherical-surface-like press section 11 ($Ro > r$). Moreover, as shown in drawing 4, in order to prevent interference with the receptacle member 14 at the time of taking the actuation angle theta, and an inner ring of spiral wound gasket 2, the inside diameter Ro of the receptacle section 15 is made larger than the outer-diameter dimension Ri of spherical external surface 2b of an inner ring of spiral wound gasket 2 ($Ro > Ri$).

[0029] In order to win popularity with the press member 10 and to control the frictional resistance between members 14, it is desirable to perform the surface treatment for winning popularity with the press section 11 of the press member 10, and making either of the receptacle sections 15 of a member 14 or both sides reduce a slide wire, for example, soft nitriding processing.

[0030] In the above configuration, if a shaft 5 is fitted into the inner circumference of an inner ring of spiral wound gasket 2 and both are positioned in snap ring 16 grade, popularity will be won with the press section 11 of the press member 10, the receptacle section 15 of a member 14 will contact mutually, and an elastic member 12 will be compressed. The elastic force of shaft orientations acts by this between the method member 6 (a shaft 5 and inner ring of spiral wound gasket 2) of inside, and a cage 4, and

relative displacement of shaft orientations arises among both. Since a ball 3 is pushed in in the contraction direction of a vault rack by this relative displacement through a cage 4, the axial internal clearance between trucks is packed and rotation backlash comes to be prevented. Thus, as a result of preventing rotation backlash, this cover-half uniform universal joint becomes possible [using it also for the steering system of the application which dislikes rotation backlash, for example, the automobile shown in drawing 13].

[0031] A steering system is changed into the reciprocating motion of the tie rod section by transmitting rotation of a steering wheel 21 to steering gear through 1 or two or more steering shafts 22, as shown in drawing 13. When a steering shaft 22 cannot be arranged in a straight line on balance with a mounted tooth space etc., 1 or two or more universal joints 24 are arranged between steering shafts 22, and it enables it to transmit exact rotation to steering gear also in the condition of having made the steering shaft 22 crooked. The above-mentioned cover-half uniform universal joint can be used for this universal joint 24.

[0032] By the way, in a cover-half uniform universal joint, a minute spherical-surface clearance is formed apart from the axial internal clearance between the above-mentioned trucks from the convenience on processing and a function between peripheral face 4b of a cage 4, and spherical inside 1b of an outer ring of spiral wound gasket 1, and between inner skin 4c of a cage 4, and spherical external surface 2b of an inner ring of spiral wound gasket 2. If the axial internal clearance between inner skin 4c of a cage 4 and spherical external surface 2b of an inner ring of spiral wound gasket 2 is smaller than the axial internal clearance between trucks among the axial internal clearances produced by this spherical-surface clearance, since the excursion of the shaft orientations of a cage 4 to an inner ring of spiral wound gasket 2 will narrow, a limitation produces the axial internal clearance between trucks to fully put. Therefore, it is necessary to set up more greatly than the axial internal clearance between trucks the axial internal clearance between a cage 4 and an inner ring of spiral wound gasket 2.

[0033] Drawing 5 shows other operation gestalten of this invention, and differs from the operation gestalt which the point which embedded the coil spring as an elastic member 12 at the axis end of a shaft 5 shows to drawing 1. In this operation gestalt, the cylinder-like hold member 17 is embedded at the axis end, and the press member 10 and an elastic member 12 are held in the interior of this hold member 17. The tip of the hold member 17 is set to interior of proposal 17a to which it bends to a bore side and shows the press member 10. Also according to this operation gestalt, the clearance between trucks can be packed like the operation gestalt of drawing 1, and rotation backlash can be prevented. Moreover, although omitted, since illustration wins popularity with the press member 10 and reduces the slide wire between members 14, it uses the press member 10 as a ball (ball), receives this, and can roll it by the concave spherical surface of a member 14.

[0034] As an elastic member 12, it can be used also except a coil spring. That for which drawing 6 (a) and (b) used the disk spring as an elastic member 12, drawing 7 (a), and (b) are the examples which used resin material (rubber material is sufficient) as an elastic member 12. In addition, although illustration is omitted, it can also use a wave spring as an elastic member 12.

[0035] In addition, the thing, drawing 6 (b), and drawing 7 (b) to which drawing 6 (a) and drawing 7 (a) have arranged the elastic member 12 out of the axis end of a shaft 5 like the operation gestalt of drawing 1 arrange an elastic member 12 in an axis end like the operation gestalt of drawing 5 using the hold member 17.

[0036] Drawing 8 is the example which formed the receptacle section 15 in the shaft 5 as an inner direction member 6, and formed the press section 11 in the cage 5 contrary to the operation gestalt of drawing 1 - drawing 7. In drawing 8, although the convex spherical-surface-like receptacle section 15 is really formed in a shaft 5, it can also attach in the axis end of a shaft 5 by making this into another member (receptacle member).

[0037] In this operation gestalt, the shape of a wrap lid is attached in the press member 10 which has the press section 11 for edge opening of a cage 4 as well as the receptacle member 14 shown in drawing 1 - drawing 7 at the edge by the side of nothing and the outer-ring-of-spiral-wound-gasket inner of a cage 4. As shown in drawing 9, the press member 10 consists of 10d of the legs of plurality (a drawing six

pieces) projected on partial spherical-surface-like spherical-surface section 10c and a periphery. The inside (a shaft 5 and field which counters) of spherical-surface section 14a is making the shape of the concave spherical surface, and functions as the press section 11 which this concave spherical-surface part wins [section] popularity, and makes the elastic force of shaft orientations act on the section 15. In order to prevent interference with the press member 10 at the time of taking an actuation angle, and an inner ring of spiral wound gasket 2, the concave spherical-surface-like press section 11 is formed in a major diameter rather than spherical external surface 2b of an inner ring of spiral wound gasket 2 (refer to drawing 4).

[0038] Drawing 10 is other operation gestalten of the press member 10, and while they reduces the number of 10d of legs compared with drawing 9 (for example, they may be three pieces), it is the example which increased the circumferencial direction width of face of 10d of legs.

[0039] As shown in drawing 8 , 4d of flanges is formed in the edge circles periphery by the side of the outer-ring-of-spiral-wound-gasket inner of a cage 4. The press member 10 is fixed to a cage 4 by making 10d of legs of the press member 10 engage with 4d of this flange. Since win popularity with the press section 11, the section 15 contacts by this, 10d of legs mainly carries out elastic deformation and elastic force is produced (refer to : drawing 9 and drawing 10 which are expressed with delta for the elastic deformation of 10d of legs in this case) Like the operation gestalt of drawing 1 , the method member 6 (a shaft 5 and inner ring of spiral wound gasket 2) of inside is pressed at an outer-ring-of-spiral-wound-gasket opening side, a cage 4 is pressed at an outer-ring-of-spiral-wound-gasket inner side, respectively, and a ball 3 is stuffed into the contraction side of a vault rack. Therefore, it becomes possible to pack the axial internal clearance between trucks and to prevent rotation backlash.

[0040] Thus, elastic force is generated for itself [press member 10], and also the elastic member 12 which produces the elastic force of shaft orientations may be made to intervene between 10d of legs of the press member 10, and 4d of flanges of a cage 4, as shown in drawing 11 and drawing 12 . As an elastic member 12, a disk spring, a wave spring, resin material, and rubber material can be used, for example. In this case, since 10d of legs moves to shaft orientations in connection with the elastic deformation of an elastic member 12, in order to avoid interference with 10d of legs, and a cage 4, it is desirable to form the minute clearance S between radial between the outer-diameter edge of 10d of legs and cage 4 inner circumference.

[0041] Although UJ which formed the straight section one a1 and two a1 in a part of truck slots 1a and 2a is mentioned as a cover-half uniform universal joint in the above explanation This invention can begin the TSUEPPA (the whole region of truck slotsa [1] and 2a was formed in the shape of [centering on the truck centers O1 and O2] curve) mold which does not have not only this but such the straight section, and can apply it to a cover-half uniform universal joint widely.

[0042]

[Effect of the Invention] Thus, according to this invention, the axial internal clearance between trucks can be packed with easy structure, and generating of rotation backlash can be prevented certainly. Therefore, it becomes possible to use cover-half uniform universal joints, such as BJ and UJ, also for the application which dislikes rotation backlash like a steering system.

[Translation done.]

【特許請求の範囲】

【請求項1】複数のトラック溝を形成した球状内面を備える外方部材と、複数のトラック溝を形成した球状外面を備える内方部材と、外方部材のトラック溝と内方部材のトラック溝とで形成された楔形のボルトラックに配置したボールと、外方部材の球状内面と内方部材の球状外面との間に配置され、ボールを保持する保持器とを備えた固定型等速自在継手において、

弾性的な押圧力を軸方向に作用させる押圧部、および押圧部からの押圧力を受ける受け部のうち、何れか一方を保持器に設けると共に、他方を内方部材に設けたことを特徴とする固定型等速自在継手。

【請求項2】弾性的な押圧力を、保持器を介してボールがボルトラックの縮小側に押し込まれるように作用させる請求項1記載の固定型等速自在継手。

【請求項3】内輪と保持器の間のアキシャル隙間を、トラック間のアキシャル隙間よりも大きくした請求項1または2記載の固定型等速自在継手。

【請求項4】押圧部および受け部のうち、保持器に設けられる一方を内方部材の球状外面よりも大径の凹球面状に形成した請求項1～3何れか記載の固定型等速自在継手。

【請求項5】押圧部および受け部のうち、内方部材に設けられる他方を上記一方よりも小径の凸球面状に形成した請求項4記載の固定型等速自在継手。

【請求項6】請求項1～5の何れかに記載された構造を有するツエッパ型の固定型等速自在継手。

【請求項7】請求項1～5の何れかに記載された構造を有するアンダーカットフリー型の固定型等速自在継手。

【請求項8】ステアリング装置に使用される請求項1～7何れか記載の固定型等速自在継手。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は固定型等速自在継手、およびこれを有するステアリング装置に関し、特に回転バックラッシュを嫌う用途に好適な固定型等速自在継手に関する。

【0002】

【従来の技術】等速自在継手は、入出力軸間の角度変位のみを許容する固定型と、角度変位および軸方向変位を許容する摺動型に大別され、それぞれ用途・使用条件等に応じて機種選定される。

【0003】固定型等速自在継手としては、ツエッパ型(以下、「BJ」と称する)やアンダーカットフリー型(以下、「UJ」と称する)が広く知られている。

【0004】BJおよびUJの何れも、内周に複数の曲線状のトラック溝を有する外輪と、外周に複数の曲線状のトラック溝を有する内輪と、外輪および内輪のトラック溝間に組み込まれたボールと、ボールを保持する保持

器とで構成される。外輪のトラックセンタは外輪内周の球面中心に対して、また、内輪のトラックセンタは内輪外周の球面中心に対して、それぞれ軸方向に等距離だけ反対側にオフセットされており、これにより外輪のトラック溝と内輪のトラック溝とで構成されるボルトラックは外輪の奥部側または開口側に向けて拡開する楔形となっている。BJは各トラック溝の全域が外輪トラックセンタおよび内輪トラックセンタを中心とする曲線状になっているが、UJでは各トラック溝の一方の端部が軸方向のストレート状になっている。

【0005】

【発明が解決しようとする課題】これらの固定型等速自在継手には、機能上および加工上の要請から外輪トラックと内輪トラックとの間に隙間が存在する。このトラック間の隙間は、継手の中立状態で内輪又は外輪の何れか一方を固定して、固定されていない他方の部材をラジアル方向またはアキシャル方向に移動させたときの移動量をいい、移動させる方向によって、それぞれラジアル隙間またはアキシャル隙間と呼ばれる。

【0006】ところで、このトラック間の隙間の大小は、内輪と外輪の間の円周方向のガタツキ(回転バックラッシュ)に大きく影響を与える(トラック間のすきまが大きいほど回転バックラッシュも大きくなる)。上述のように固定型等速自在継手では、トラック間の隙間が不可欠であり、そのため一定以上の回転バックラッシュの発生は避けられないことから、この種の固定型等速自在継手は、例えば自動車のステアリング装置のように回転バックラッシュを嫌う用途に一般採用されるまでには至っていない。

【0007】そこで、本発明は、回転バックラッシュを嫌う用途での使用に好適な固定型等速自在継手の提供を目的とする。

【0008】

【課題を解決するための手段】上記目的の達成のため、本発明では、複数のトラック溝を形成した球状内面を備える外方部材と、複数のトラック溝を形成した球状外面を備える内方部材と、外方部材のトラック溝と内方部材のトラック溝とで形成された楔形のボルトラックに配置したボールと、外方部材の球状内面と内方部材の球状外面との間に配置され、ボールを保持する保持器とを備えた固定型等速自在継手において、弾性的な押圧力を軸方向に作用させる押圧部、および押圧部からの押圧力を受ける受け部のうち、何れか一方を保持器に設けると共に、他方を内方部材に設けた。

【0009】このように押圧部および受け部をそれぞれ内方部材や保持器に設けることにより、弾性力によって内方部材と保持器とが軸方向に相対移動する。これにより、ボールを介してトラック間の隙間(アキシャル隙間)が詰められるので、回転バックラッシュを防止することが可能となる。

【0010】具体的に説明すると、例えば図1に示すように、押圧部11を内方部材6に、受け部15を保持器4にそれぞれ設けた場合は、押圧部11と受け部15の弾性的な当接により、保持器4が外方部材1の奥部側に、内方部材2が外方部材1の開口側にそれぞれ押圧され、両者間に軸方向の相対移動が生じる。この相対移動により、ボール3が保持器4を介してボールトラックの縮小方向に押し込まれるため、トラック間のアキシャル隙間が詰められ、回転バックラッシュの発生が防止される。一方、図8に示すように押圧部11を保持器4に、受け部15を内方部材6にそれぞれ設けた場合も、同様にボール3がボールトラックの縮小方向に押し込まれ、その結果、トラック間のアキシャル隙間が詰められて回転バックラッシュが防止される。

【0011】以上からも明らかなように、弾性的な押圧力は、ボールがボールトラックの縮小側に押し込まれるように作用させる必要がある。弾性的な押圧力の発生手段としては、コイルばね、波ばね、皿ばね等のバネ部材や、樹脂、ゴム等の弹性材料からなる弹性部材が考えられる。

【0012】ところで、一般に固定型等速自在継手においては、加工上および機能上の理由から、内輪と保持器の間、および外輪と保持器の間に微小な球面隙間が形成される。このうち、内輪と保持器の間の球面隙間で形成されるアキシャル隙間がトラック間のアキシャル隙間よりも小さいと、トラック間のアキシャル隙間が完全に詰められる以前に内輪と保持器が当接するため、それ以上トラック間のアキシャル隙間を詰めることには限界がある。従って、内輪と保持器の間のアキシャル隙間は、トラック間のアキシャル隙間よりも大きくするのが望ましい。

【0013】押圧部11および受け部15のうち、保持器4に設ける一方（例えば図1では受け部15）は内方部材6の球状外面2bよりも大径の凹球面状に形成するのが望ましい。これにより作動角をとった際にも、保持器4に設けた一方が内方部材6の球状外面2bと接触・干渉する事態を防止でき、スムーズな角度変位が可能となる。

【0014】押圧部11および受け部15のうち、内方部材6に設けられる他方（上記例示では押圧部11）を上記一方よりも小径の凸球面状に形成すれば、押圧部11と受け部15をスムーズに摺動させることができ、作動角の変位を容易に行えるようになる。

【0015】以上から、上述した何れかの構造を有するツエッパ型あるいはアンダーカットフリー型の固定型等速自在継手は、回転バックラッシュを生じず、従ってこれらの固定型等速自在継手は、ステアリング装置のように回転バックラッシュを嫌う用途にも好適なものとなる。

【0016】上記固定型等速自在継手をステアリング装

置に使用すれば、回転バックラッシュが存在しないために良好な操舵感を得ることができ、走行中の振動も少なくすることができる。

【0017】

【発明の実施の形態】以下、本発明の実施形態を図1～図13に基づいて説明する。

【0018】図1～図12は、本発明を固定型等速自在継手の一種であるアンダーカットフリー型（UJ）に適用した場合を例示するものである。

【0019】図1に示すように、このタイプの等速自在継手は、複数のトラック溝1aを形成した球状内面1bを備える外方部材としての外輪1と、複数のトラック溝2aを形成した球状外面2bを備える内輪2と、外輪1のトラック溝1aと内輪2のトラック溝2aとの協働で形成されるボールトラックに配された複数のボール3と、外輪1の球状内面1bと内輪2の球状外面2bとの間に配置され、ボール3を収容するためのポケット4aを円周方向等間隔に有する保持器4とを主要な構成要素とするものである。トラック溝1a、2aは軸方向に延びる曲線状をなし、通常は6本（または8本）がそれぞれ球状内面1bおよび球状外面2bに形成される。内輪2の内間にセレーションやスプライン等のトルク伝達手段を介してシャフト5を結合することにより、内方部材6が構成される。

【0020】この実施形態において、外輪1のトラック溝1aの溝底が曲面状になった部位の中心（外輪トラックセンタ） O_1 は、外輪1の球状内面1bの球面中心に対して、内輪2のトラック溝2aの溝底が曲線状になった部位の中心（内輪トラックセンタ） O_2 は、内輪2の球状外面2bの球面中心に対して、それぞれ軸方向に等距離だけ反対側にオフセットされている。

【0021】保持器4の外周面4bの球面中心、および保持器外周面4bの案内面となる外輪1の球状内面1bの球面中心は、何れも継手中心 O に一致している。また、保持器4の内周面4cの球面中心、および保持器内周面4cの案内面となる内輪2の球状外面2bの球面中心も同様に継手中心 O に一致している。それ故、外輪トラックセンタ O_1 と継手中心 O との間の距離となり、内輪トラックセンタ O_2 と継手中心 O との間の軸方向距離となり、両者は等しい。

【0022】以上から、一対のトラック溝1a、2aにより外輪1の開口側から奥部側へ縮小する楔状のボールトラックが形成され、このボールトラックに各ボール3が転動可能に組み込まれる。

【0023】図1では、保持器4の外周面4bおよび内周面4cの球面中心を継手中心 O に一致させているが、これらの球面中心を継手中心 O に対して軸方向のそれぞれ反対側に等距離だけオフセットさせることもできる。

【0024】この固定型等速自在継手において、図4に

示すように、外輪1と内輪2とが作動角 θ をとると、保持器4に案内されたポール3が常にどの作動角 θ においても角度 θ の二等分面($\theta/2$)内に維持され、継手の等速性が確保される。UJでは、外輪1のトラック溝1aの一方側(外輪開口側)の端部、および内輪2のトラック溝2aの他方側(外輪奥部側)の端部にそれぞれ溝底を軸心と平行にしたストレート部1a1, 2a1が形成されているため、作動角 θ の最大値を50°程度にとることができ、一般的なBJの最大許容作動角(46°程度)よりも大きくすることができる。

【0025】なお、外輪1と内輪2の間でスムーズな回転作動を得るために、保持器4のポケット4aとポール3の間は円周方向および軸方向のそれぞれで正隙間とする。

【0026】図1に示すように、内方部材6を構成するシャフト5の軸端(外輪奥部側)には、押圧部材10が取り付けられる。図示例の押圧部材10は、図2に示すように円筒状の胴部10aと、これよりも外径側に張り出した頭部10bとを具備しており、シャフト5と同軸に配置した状態で胴部10aがシャフト軸端に軸方向へスライド可能に挿入されている。頭部10bとシャフト軸端との間には弾性部材12としてコイルバネが介装され、この弾性部材12は押圧部材10を軸方向の外輪奥部側へ押圧する弾性力の発生源となる。頭部10bの端面は凸球面状に形成され、この凸球面部分が弾性的な押圧力を軸方向に作用させる押圧部11として機能する。

【0027】保持器4の外輪奥部側の端部には、受け部材14が取り付けられる。この受け部材14は、保持器4の外輪奥部側の端部開口を覆う蓋状をなし、部分球面状の球面部14aとその外周に環状に形成された取付け部14bとで構成される。球面部14aの内面(シャフト5と対向する面)は凹球面状で、この凹球面部は押圧部11からの押圧力を受ける受け部15として機能する。取付け部14bは、保持器4の端部に圧入、溶接等の適宜の手段で固定されている。

【0028】作動角をとった際に、押圧部材10と受け部材14をスムーズに摺動させるため、図3に示すように、凹球面状の受け部15の内径寸法Roは、凸球面状の押圧部11の外径寸法rよりも大きくする($Ro > r$)。また、図4に示すように作動角 θ をとった際の受け部材14と内輪2との干渉を防止するため、受け部15の内径寸法Roは、内輪2の球状外面2bの外径寸法Riよりも大きくする($Ro > Ri$)。

【0029】押圧部材10と受け部材14の間の摩擦抵抗を抑制するため、押圧部材10の押圧部11と受け部材14の受け部15の何れか一方、または双方には、滑り抵抗を低減させるための表面処理、例えば軟窒化処理を施すのが望ましい。

【0030】以上の構成において、シャフト5を内輪2の内周に嵌合し、止め輪16等で両者を位置決めする

と、押圧部材10の押圧部11と受け部材14の受け部15とが互いに当接し、弾性部材12が圧縮される。これにより内方部材6(シャフト5および内輪2)と保持器4との間に軸方向の弾性力が作用し、両者間に軸方向の相対移動が生じる。この相対移動によりポール3が保持器4を介してポールトラックの縮小方向に押し込まれるため、トラック間のアキシャル隙間が詰められ、回転バックラッシュが防止されるようになる。このように回転バックラッシュが防止される結果、この固定型等速自在継手は、回転バックラッシュを嫌う用途、例えば図13に示す自動車のステアリング装置にも使用することが可能となる。

【0031】ステアリング装置は、図13に示すように、ステアリングホイール21の回転運動を、一または複数のステアリングシャフト22を介してステアリングギヤに伝達することにより、タイロッド部の往復運動に変換するものである。車載スペース等との兼ね合いでステアリングシャフト22を一直線に配置できない場合は、ステアリングシャフト22間に一または複数の自在継手24を配置し、ステアリングシャフト22を屈曲させた状態でもステアリングギヤに正確な回転運動を伝達できるようにしている。この自在継手24に上記固定型等速自在継手を使用することができる。

【0032】ところで、固定型等速自在継手においては、加工上および機能上の都合から、上記トラック間のアキシャル隙間とは別に保持器4の外周面4bと外輪1の球状内面1bとの間、および保持器4の内周面4cと内輪2の球状外面2bとの間に微小な球面隙間が形成される。この球面隙間により生じるアキシャル隙間のうち、保持器4の内周面4cと内輪2の球状外面2bとの間のアキシャル隙間がトラック間のアキシャル隙間よりも小さいと、内輪2に対する保持器4の軸方向の可動域が狭まるため、トラック間のアキシャル隙間を十分に詰めることに限界が生じる。従って、保持器4と内輪2の間のアキシャル隙間は、トラック間のアキシャル隙間よりも大きく設定する必要がある。

【0033】図5は、本発明の他の実施形態を示すもので、弾性部材12としてのコイルバネをシャフト5の軸端に埋め込んだ点が図1に示す実施形態と異なる。この実施形態においては、軸端に円筒状の収容部材17が埋め込まれており、この収容部材17の内部に押圧部材10および弾性部材12が収容される。収容部材17の先端は内径側に折り曲げて押圧部材10を案内する案内部17aとしている。この実施形態によても図1の実施形態と同様にトラック間の隙間を詰めて、回転バックラッシュを防止することができる。また、図示は省略するが、押圧部材10と受け部材14の間の滑り抵抗を低減させるため、押圧部材10をポール(球)とし、これを受け部材14の凹球面で転がすようにすることもできる。

【0034】弾性部材12としては、コイルバネ以外も使用することができる。図6(a)(b)は、弾性部材12として皿ばねを使用したもの、図7(a)(b)は、弾性部材12として樹脂材(ゴム材でもよい)を使用した例である。この他、図示は省略するが弾性部材12として波ばねを使用することもできる。

【0035】なお、図6(a)および図7(a)は、図1の実施形態と同様に弾性部材12をシャフト5の軸端外に配置したもの、図6(b)および図7(b)は、図5の実施形態と同様に収容部材17を使用して弾性部材12を軸端内に配置したものである。

【0036】図8は、図1～図7の実施形態とは逆に、受け部15を内方部材6としてのシャフト5に、押圧部11を保持器5に設けた例である。図8では、凸球面状の受け部15をシャフト5に一体形成しているが、これを別部材(受け部材)としてシャフト5の軸端に取り付けることもできる。

【0037】この実施形態において、押圧部11を有する押圧部材10は、図1～図7に示す受け部材14と同様に、保持器4の端部開口部を覆う蓋状をなし、保持器4の外輪奥部側の端部に取り付けられる。図9に示すように、押圧部材10は、部分球面状の球面部10cとその外周に突出した複数(図面では6個)の脚部10dとで構成される。球面部10aの内面(シャフト5と対向する面)は凹球面状をなしており、この凹球面部分が受け部15に軸方向の弾性力を作用させる押圧部11として機能する。作動角をとった際の押圧部材10と内輪2との干渉を防止するため、凹球面状の押圧部11は、内輪2の球状外面2bよりも大径に形成される(図4参照)。

【0038】図10は、押圧部材10の他の実施形態で、図9に比べ、脚部10dの数を減じる一方で(例えば3個とする)、脚部10dの円周方向幅を増した例である。

【0039】図8に示すように、保持器4の外輪奥部側の端部内周には、鍔部4dが形成される。この鍔部4dに押圧部材10の脚部10dを係合させることにより、押圧部材10が保持器4に固定される。これにより、押圧部11と受け部15とが当接し、主として脚部10dが弾性変形して弾性力を生じるので(この場合の脚部10dの弾性変形量は δ で表される:図9および図10参照)、図1の実施形態と同様に内方部材6(シャフト5および内輪2)が外輪開口側に、保持器4が外輪奥部側にそれぞれ押圧され、ポール3がポールトラックの縮側に押し込まれる。従って、トラック間のアキシャル隙間を詰めて回転バックラッシュを防止することが可能となる。

【0040】このように押圧部材10自身で弾性力を発生させる他、図11および図12に示すように、押圧部材10の脚部10dと保持器4の鍔部4dとの間に軸方

向の弾性力を生じる弾性部材12を介在させてもよい。弾性部材12としては、例えば皿ばね、波ばね、樹脂材やゴム材を使用することができる。この場合、弾性部材12の弾性変形に伴って、脚部10dが軸方向に移動するので、脚部10dと保持器4との干渉を回避するため、脚部10dの外径端と保持器4内周との間に半径方向の微小隙間Sを形成するのが望ましい。

【0041】以上の説明では、固定型等速自在継手として、トラック溝1a, 2aの一部にストレート部1a1, 2a1を形成したUJを挙げているが、本発明はこれに限らず、このようなストレート部を有しない(トラック溝1a, 2aの全域がトラックセンタO₁, O₂を中心とする曲線状に形成された)ツェッパ型を始め、固定型等速自在継手に広く適用することができる。

【0042】

【発明の効果】このように本発明によれば、簡単な構造でトラック間のアキシャル隙間を詰めることができ、確実に回転バックラッシュの発生を防止することができる。従って、ステアリング装置のような回転バックラッシュを嫌う用途にもBJやUJといった固定型等速自在継手を使用することが可能となる。

【図面の簡単な説明】

【図1】押圧部を内方部材に、受け部を保持器に設けた固定型等速自在継手の実施形態を示す断面図である。

【図2】図1の実施形態におけるシャフト軸端付近の拡大断面図である。

【図3】図1の実施形態における要部拡大断面図である。

【図4】作動角をとった固定型等速自在継手の断面図である。

【図5】他の実施形態を示す断面図である。

【図6】弾性部材の他例を示す拡大断面図で、(a)図は弾性部材をシャフト外に配置した場合、(b)図は弾性部材をシャフト内に配置した場合を示す。

【図7】弾性部材の他例を示す拡大断面図で、(a)図は弾性部材をシャフト外に配置した場合、(b)図は弾性部材をシャフト内に配置した場合を示す。

【図8】押圧部を保持器に、受け部を内方部材に設けた固定型等速自在継手の実施形態を示す断面図である。

【図9】(a)図は保持器に取り付ける弾性部材の断面図(Z-Z断面)、(b)図は同じく正面図である。

【図10】(a)図は保持器に取り付ける弾性部材の断面図(Z-Z断面)、(b)図は同じく正面図である。

【図11】図10の実施形態において、押圧部材と保持器の間に弾性部材を介在させた実施形態を示す断面図である。

【図12】図11中のA部の拡大断面図である。

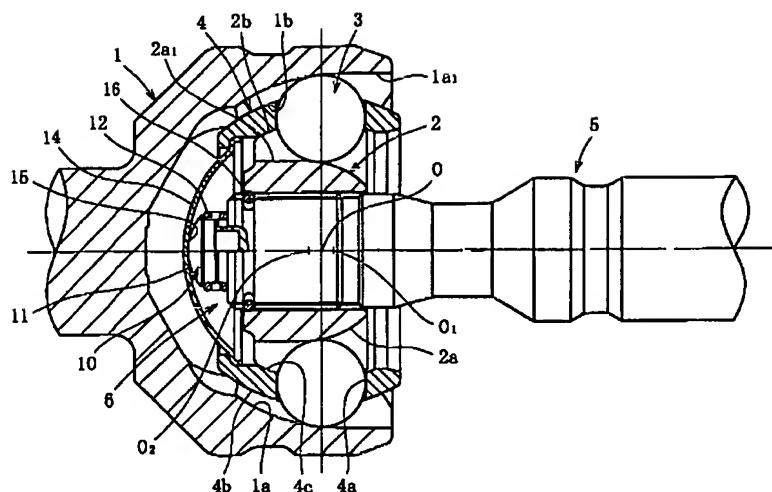
【図13】ステアリング装置の斜視図である。

【符号の説明】

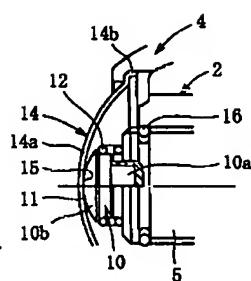
1 a トラック溝
 1 a 1 ストレート部
 1 b 球状内面
 2 内輪
 2 a トラック溝
 2 a 1 ストレート部
 2 b 球状外面
 3 ポール
 4 保持器
 4 a ポケット
 4 b 外周面

4 c 内周面
 5 シャフト
 6 内方部材
 10 押圧部材
 11 押圧部
 12 弹性部材
 14 受け部材
 15 受け部
 O 繰手中心
 O₁ 外輪トラックセンタ
 O₂ 内輪トラックセンタ

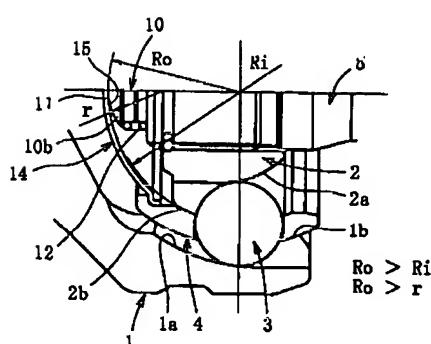
【図1】



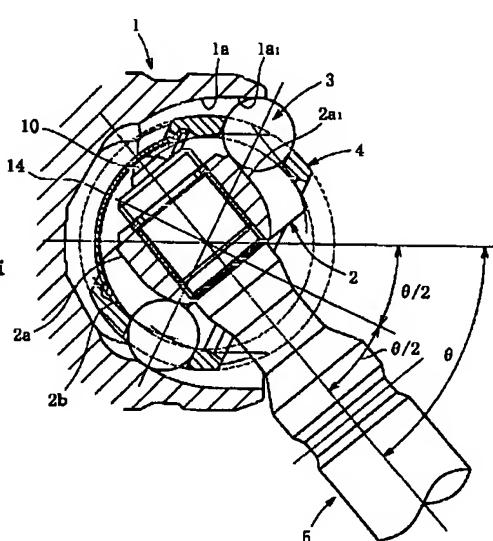
【図2】



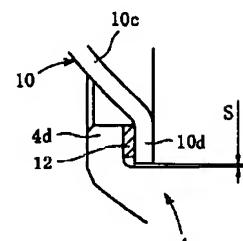
【図3】



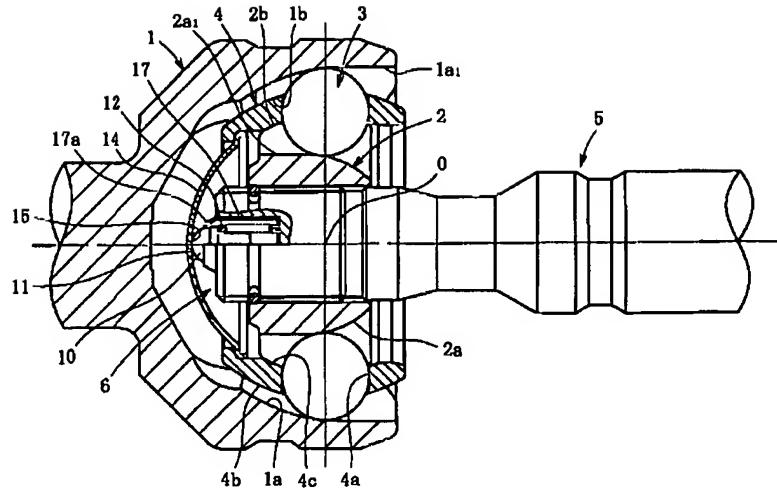
【図4】



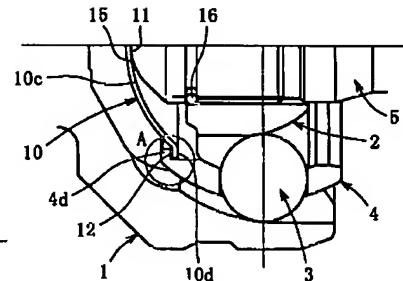
【図1-2】



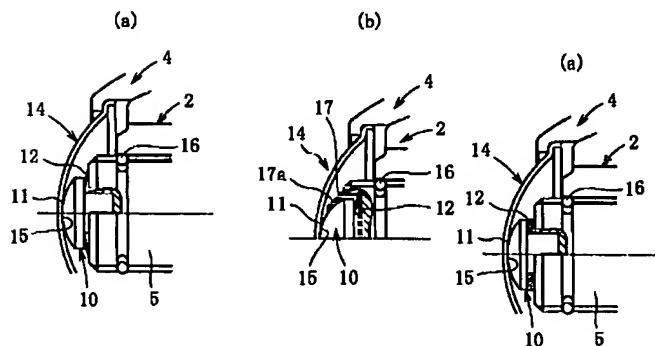
【図5】



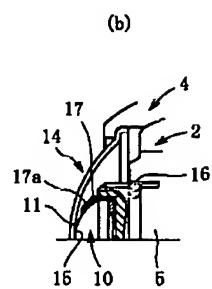
【図11】



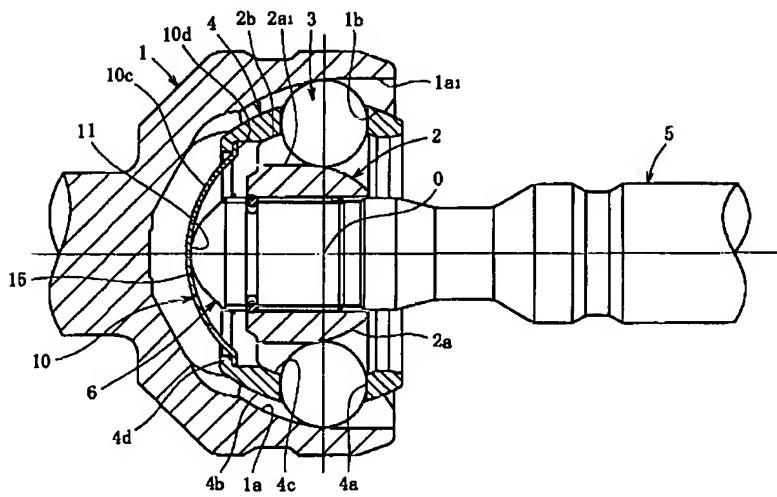
【図6】



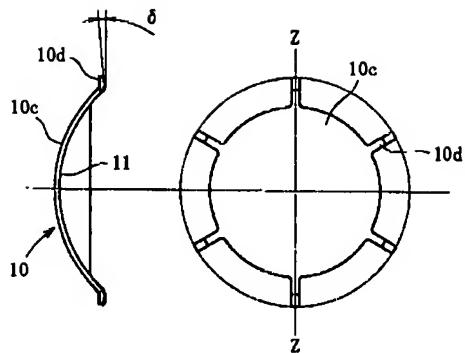
【図7】



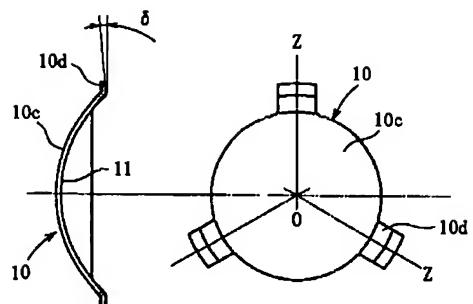
【図8】



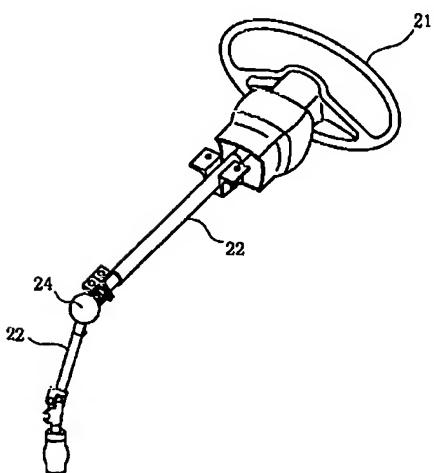
【図9】



【図10】



【図13】



フロントページの続き

(72)発明者 寺田 健二
静岡県磐田市東貝塚1578番地 エヌティエ
ヌ株式会社内

(72)発明者 蔵 久昭
静岡県磐田市東貝塚1578番地 エヌティエ
ヌ株式会社内
F ターム(参考) 3D030 DC40 DE42